Modelling e-participation implementation: A network-based approach for online and offline participation*

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Abstract

E-participation consists of several phases such as planning, implementation and evaluation. However, when representing this process, the implementation phase tends to be considered as a single block (the so-called "black-box"). This becomes a problem when the implementation combines offline and online methods, as it requires a detailed characterization and representation of all elements involved. In this paper we tackle this issue by proposing a network-based model to describe these methods. This choice is motivated by the fact that network models allow to better describe the distributed nature of these activities. To build this model we make use of the theory in Social Networks Analysis (SNA) to represent the main interactions between all actors involved. To asses the reliability and added value of the presented model, this approach is applied to four different use cases that showcase various combinations of online and offline participation methods. The results of these use cases show the great potential of the network-based model as a tool for designing, comparing and evaluating different types of implementations. Namely, the visualization of the model allows to asses the level of participation, the role of the different actors and how different instruments are combined.

Keywords

E-participation, Network-based modelling, Participation methods

1. Introduction

E-participation aims at enabling and enhancing public participation through the use of technology. In this context, the ultimate goal is to engage citizens in a communication and cooperation process with the government. Various authors stress the fact that the use of Information and Communication Technologies (ICT) does not provide a complete solution to the main participation challenges [1, 2], and that the combination of e-participation with traditional offline methods is required to reach a broader audience and a higher rate of success. However, combining different participation methods (online and offline) is not undemanding, and to properly achieve this aspiration a clear characterization of all the different elements involved in the implementation of these methods is necessary.

Proceedings *EGOV-CeDEM-ePart* conference September 5-7, 2023, Budapest, Hungary

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CEUR Workshop Proceedings (CEUR-WS.org)

CEUR-WS.org/Vol-3449/paper6.pdf

During the last years, there has been a strong effort in the e-participation field to formally define the different phases of the participation process [3]. In general, the e-participation process can be broadly divided into an initial phase of planning, an implementation phase and then an evaluation phase [3].

Recent works provide an overall picture of all the mentioned phases, the actors involved and their relationships [4, 5]. These approaches are necessary so to obtain an extensive overview of the e-participation process [6]. However, given the convoluted nature of this kind of processes, these models produce very complex representations of all the elements involved in e-participation which hinders their use during the development of the participation process.

Among the aforementioned phases of e-participation, the planning and the implementation can be seen in a sequential manner. The outcome from the planning and preparation phase will influence the duration, goal and resources associated to the implementation. In that sense, there are not that many studies focused exclusively on the modelling of the implementation part, examining the different methods and their complementarity [7], which leads to the representation of this phase as a single element (black box) in the context of large integrative models. This absence of a more specific characterization has been observed as a possible limitation to the application of e-participation by inexperienced practitioners [8] and developing countries [9]. In these scenarios, detailed information regarding the implementation could help less experienced practitioners to more effectively implement these participation methods.

To this end, we propose a model that focuses on the description of the different methods applied during the implementation phase. Given the aforementioned sequentiality of the process, the use of a phase-specific model does not have a detrimental effect on the other phases or the overall participation process. Thus, the design of a implementation-oriented model can be see as an additional tool in a general and integrative approach rather than an alternative to these models. In that regard, we propose the use of a network-based model to obtain this representation. Network models are a common tool to describe social interactions where the main appeal lies in the distribution and interconnection between the different agents [10]. This method allows us to obtain a more detailed description, not only of the amount of actors and resources, but also their roles and distribution.

2. Related work: Modelling approaches to e-participation

In her seminal paper about e-participation, Macintosh [11] refers to the need of properly characterizing the different e-participation processes so to define a standard way to describe the actions and outcomes of these activities. Since then, this formalization has been extended by providing the relations between these concepts in the form of ontologies, metamodels and semantic descriptions [12, 4, 5].

Within this context, Porwol et al. [5] provide an integrated ontology for e-Participation initiatives. Their work aims at producing a controlled and formal vocabulary for e-participation demands, where they implement an integrative model that comprises the platform conceptualization, the project conceptualization, and the democratic process. In the same line, Yusuf et al. [13] provide an e-participation framework where several aspects concerning participants and government complexity are discussed. Islam [14] develops a sustainable framework for the

development of an implementation model, but most aspects of the framework are theoretical concepts envisioning a future implementation. As mentioned by Santamaria-Philco et al. [3], these frameworks were mainly conceived as theoretical constructions not very suitable for implementation. While frameworks and ontologies provide the overall conceptual structure of a process, models explore the specific implementations [15]. Thus, these works constitute a solid foundation to construct our model, as they define and characterize the main elements of participation, while we provide a more practical focus to the representation of the process itself. By focusing on the relations within the process, we can better analyze the differences and similarities between online or offline approaches.

The modelling of the main interactions during e-participation can help to better understand the complex participation process [16]. Networks and agent-based models have been used in several fields where there is a clear need to understand social interactions [17]. In the field of citizen participation, agent-based modelling (ABM) has been used to model citizen participation activities and to make predictions of the complex behaviour from citizens based on stochastic simulations [18, 19]. To be able to evaluate the outcome of these simulations they randomly define the attributes associated to each agent based on broad and general data collected from interviews to citizens of the area. The main inconvenient of these approaches is that they rely on approximations and random generation of some social elements, making them very valuable in simulations to observe macroscopic behaviour but not suitable for descriptiveness of given implementations.

Social networks can also be used in a more descriptive manner. Kautz [16] uses complex adaptive systems to describe the connections in distributed participatory methods. Piperagkas et al. [20] modelled participation processes as a social participation network including implicit actions like possible interest or possible collaboration, as well as contextual aspects like themes. While the approach is very interesting from a theoretical point of view, it provides a model that might be hard to implement as many aspects are hard to measure, e.g., the action of *may have interest in*.

In this work, we go towards a more functional model that can be implemented based on more objective and easily accessible information. We aim at following the approach of network-based models by adapting the framework to the e-participation context. The main difference with previous works is that we aim at a model that is descriptive, based on observable data, and that can be regularly implemented.

3. Methodology

3.1. Research questions

The goal of this paper is to develop a model that describes the implementation phase of the e-participation process. In order to build the proposed modelling approach we rely on Design Research Science (DSR). This well-established research method allows creating an artifact, in this case a model, by generating new knowledge for researchers but also directly usable by practitioners, which are precisely the main goals of this work. DSR methodology can be defined by three iterative cycles: the relevance cycle, the rigor cycle and the design cycle [21].

As part of the rigor cycle, we initially reviewed the literature concerning the different online and offline participation methods and the existing models related to the description of these methods. This review of the literature allows us to build upon existing models and to define which are the important elements of the implementation of participation methods.

To design and develop the proposed model, we make use of the existing theory in social network analysis [10]. Based on the fundamental aspects of social network representation, we define the key dimensions of participation processes extracted from the e-participation literature so to properly generate all the elements of the network-based model.

The relevance cycle in this work concerns the validation of the model in the citizen participation context, and the possible added value provided by this new approach. These questions have been initially answered by implementing the presented model to different use cases found in the literature. This exercise helped to demonstrate that the model can be applied to different methods, how it can be implemented, and to show its potential. This research design approach is summarized in Fig. 1.

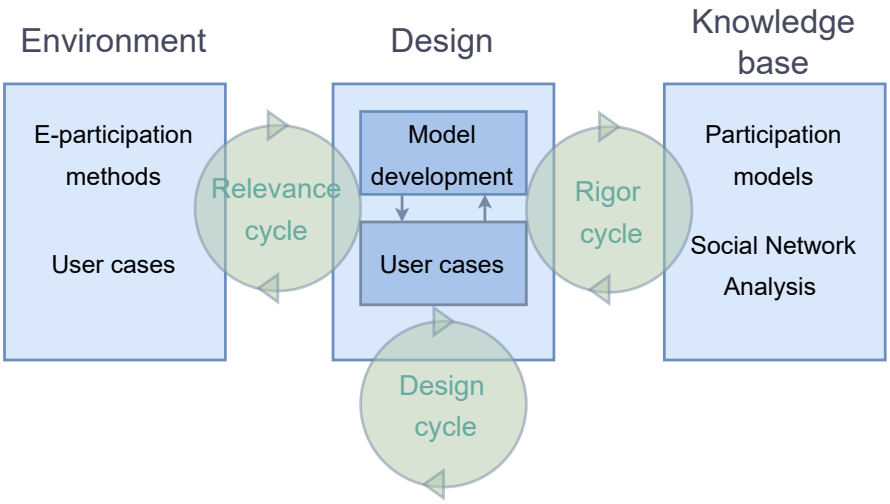


Figure 1: Design science methodology applied to this work.

The relevance cycle was carried out at the literature review level. We selected 4 use cases where detailed information about their implementation could be found online, either in scientific literature or on websites or and reports. The first two use cases were selected due to their similarities in the goal of the e-participation, citizens involved in service development, and their use of equivalent offline methods. The two other use cases showcase projects which were focused on citizens involved in the decision making.

4. Network-based model

Citizen participation (consisting of online and offline methods), as any collaborative process, builds networks; networks of contacts, information and interactions [22]. Depending on these

interactions the outcome of the participation process might change. Equivalently, these factors will affect the topology and structure of the network created [23].

Participation methods imply and require social connections. These connections while not representing all the aspects of the participation process, represent several important elements such as: engagement, interactions and information. In this sense, tracking indicators associated to these elements relying on a network-based model can become a very interesting tool for practitioners.

The main focus during the implementation of this kind of models lies on the representation of the different flows of information and connections between the agents involved. Following this idea, we model participation processes as a social participation network [10].

Network models are composed of two kinds of elements; nodes and edges. Nodes are the agents composing the network, in this case the main elements of the participation process; actors, tools or platforms. Edges represent the relations between agents, which in the participation context describe the different kind of "ties" between these elements. In the following, these two categories are further developed.

4.1. Nodes

During the participation process, different kinds of actors are involved. Common classifications of the main e-participation actors include: citizens, policymakers, external stakeholders and facilitators [11]. In the presented model, we group stakeholders based on their roles in the participation process given that it will be their role which will define their importance and actions in the participation method.

We define as nodes of the network any kind of agent that generates, provides or collects information. We initially define 4 types of nodes that represent different roles in the implementation of participation methods:

- **Participants**: Citizens that are directly involved in one or multiple stages of the participation method.
- **Facilitators**: Agents that collect information and coordinate the participation process.
- **Target audience**: Subset of citizens targeted by the participation process and the outcome of the activity. Depending on the goal of the participation process, the target audience might represent the whole population or only a specific part of it.
- **Platform/tool**: Elements of the participation method that receive, provide or analyze information but are not active in nature. This is the case of prototypes or artifacts that are generated as outcome of a given process.

In some online participation methods, there might exist cyber equivalents of a human facilitator, e.g, chatbots. In that case they are considered the same type of node as a human, as their function is similar. On the other hand, artifacts that are built based on the requirements stated by the participants or containers of information are considered as platforms and tools, given that they lack of any coordination purpose.

4.2. Edges

The second element that constitutes a network model concerns the connections between the different actors. These connections are represented by edges of the network.

In social networks, there might exist different kinds of relations between the nodes that create the graph [10]. The resulting networks can be modelled as multivariate graphs, where for a given set of nodes there exist several sets of links describing different kinds of relationships [24]. In the participation process, we defined the following types of edges:

- **Communication**: Communication is seen as any sharing of information, e.g. a discussion between two actors or interaction between actors and platforms.
- **Action**: Interactions that are directly related to the creation of a service or another actor actions. Usually, this is processing of information or the selection of proposals.
- **Representation**: Unilateral connection that defines how accurate are the attributes of the targeted citizen represented by the associated participants.

The several kinds of edges create a multivariate network that can be represented in one or several figures [25]. These links are direct and the connection are not symmetric, such that connections might have only one sense or have different strength depending on the sense of the connection, creating a so-called *direct graph*. These edges might have different thickness representing a stronger connection [16].

5. Model implementation

5.1. Implementation steps

The goal of this paper is not only to present the approach and its application, but also to provide enough information regarding its implementation. This implementation approach follows traditional SNA methodology where first actors are identified, based on these actors, ties are created, and then the network is visualized [26]. The proposed steps for the implementation of the model are:

1. **Define the nodes**. Define which are the main actors and their roles in the participation method. Start from the target audience identifying which are the group (or groups) that the participation process is aiming at. Based on that target audience create the node(s) of participants. Then, determine if there is any tool or platform used in this participation phase, e.g. portal or survey platform. Finally, identify the facilitators, separating them if there is any difference in their roles or activities.
2. **Make the connections**. The second step is to create the connections (communication, action and representation) between the nodes. The main benefit of this step is to re-evaluate the definition of the nodes, as the connections demand the understanding the role of each group.
3. **Visualization**. The last step, visualization, helps to define the scope and the granularity of the obtained model, as it will be displayed graphically.

5.2. Visualization principles

We define a systematic methodology to visualize and interpret the model outcome. To do so we rely in common practices in heterogeneous multigraphs, where color codes are used as variables, see [27, 28].

- *Nodes.* Different colors represent different kind of nodes. In this case we propose; orange as target audience, blue as participant, green as facilitator and red for the tools.
- *Edges.* Different kinds of line allow to differentiate the kind of connection between nodes. We propose to use; dotted lines as representation, solid lines as communication and dashed lines for actions.
- *Weights.* Different line widths represent the different strength of the connections.

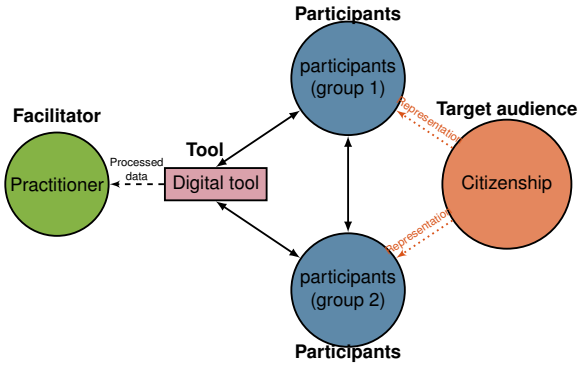


Figure 2: Example of the outcome of the model implementation.

An example of the outcome of the model is depicted in Fig. 2. Note that this choice of colors and line types is an initial attempt to obtain a consistent nomenclature.

5.3. Use cases

5.3.1. Use case 1: Social support e-service

This first use case was presented in [29]. It provides a scenario where an engineering requirements approach is applied to create a social support e-Service in the Netherlands. The participation process consists of: interviews with citizens and public servants, a low fidelity prototype and a citizen walk-through. For the sake of comparison, we only focus on the interview's stage during our evaluation.

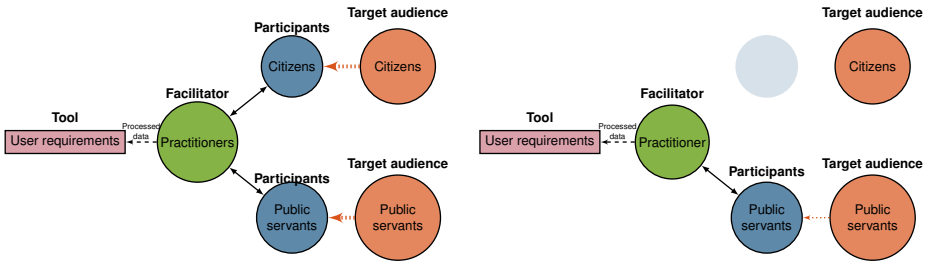
In this case, the target audience is quite reduced; citizens with special needs and public servants involved with the developed service. The participants are divided into citizens and public servants, as they conduct two different kinds of interviews. Regarding the connections, we can identify the representation relation between the target audience and the selected participants. In both cases this connection is strong as there are two identified groups of participants that correspond to the profiles of direct and indirect users. The method used are semi-structured interviews, so we can establish a two-ways communication between interviews and interviewers. Then, based on the information obtained, the practitioners create the user requirements which is considered as an action. This provides the graph in Fig. 3a.

5.3.2. Use case 2: E-government project La louvière

This use case focuses on the implementation of an e-government strategy at the city of La Louvière (Belgium) thanks to the development of a Digital portal [30]. Three different participation methods were applied; interviews and group discussions, prototyping and a survey. Again, we focus on the interviews and group discussions, see Fig. 3b.

Concerning the target audience, similarly to the previous case, the main targeted group were citizens and public servants. Notably, in this case the citizens' target audience was larger, as the service was aimed at a broader group. In this implementation, there is no connection, i.e. lack of participation, to one of the groups of target audience; citizens. Also, not all public servants interviewed were actively involved in the creation of the Digital portal. This implies a lower weight in the representation edges.

As mentioned, when applying the model to this method implementation some potential issues are easily spotted. For instance, the fact that there is a complete group of target audience that is not connected to the process or that compared to the previous case the "representation" is considered low for the case of public servants.



(a) Interviews phase in [29].

(b) Interviews and group discussion phase in [30].

Figure 3: Network model visualization of use cases 1 and 2.

5.3.3. Use case 3: Lets prepare Brussels

This use case showcases an initiative of the Brussels region (Belgium) to design new environmental projects in the post-covid context[1]. In the first part of this participation process, a survey was carried out by two entities; *Dedicated* company and *Bruxelles Environnement*. The survey was performed in 3 different modalities; via an internet platform in the case of *Bruxelles Environnement*, and internet or phone surveys in the case of *Dedicated*. The implementation of the model can be seen in Fig. 4a.

The participants are divided into 3 groups based on the method used for the interview. From Fig. 4a it can be seen that the representation from citizens chosen for the survey platform is lower, as the data indicated a clear bias in their selection, while the participants interviewed by telephone have a stronger communication link as the average duration of their interaction (37 minutes) was considerably longer than the ones by internet (18 minutes).

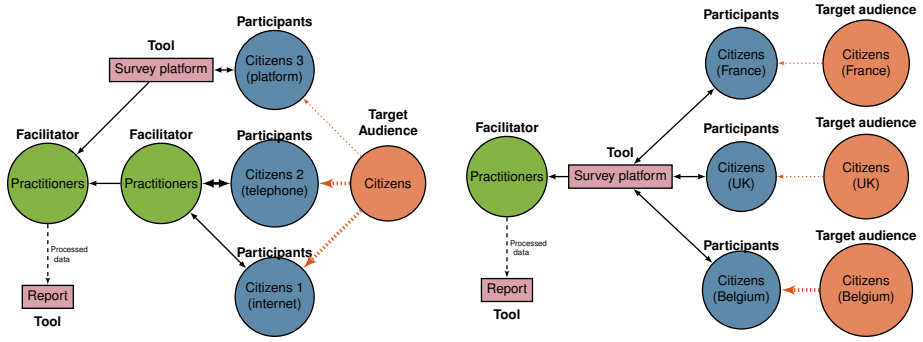
[1] https://letsprepare.monopinion.brussels

This implementation of the model shows a more complex scenario with different instruments used to collect data. In that regard, it provides good overview of how these methods are implemented and where are the main differences in terms of application.

5.3.4. Use case 4: Healthy data project

This use case describes a public e-consultation related to the reuse of citizen health data[2]. The consultation focused primarily on the countries of France, Belgium and the UK. A common survey platform was used to gather all the contributions supported by a large-scale communication campaign. The outcome of applying the proposed model to this implementation can be seen in Fig. 4b.

The target audience is divided into 3 groups based on the nationality. The representation edges are only based on the number of participants of each country as there was no more information due to the anonymity of the survey. Figure 4b shows the central importance of the survey platform as it is the main interaction with participants and all data collection goes through this platform.



(a) Survey strategy performed for *Lets prepare Brussels*.

(b) Consultation carried out for the *Healthy data project*.

Figure 4: Network model visualization of *Lets prepare Brussels* and *Healthy data project*.

6. Discussion

6.1. Theoretical contributions

The main theoretical contributions of this model to the research field of e-participation aim at filling the current gap in the description of how participation methods are implemented.

The first contribution is related to the detailed characterization of online and offline methods provided by the model. As already pointed by Macintosh [11], the proper comparison and evaluation of different participation projects requires a more detailed characterization than the one provided by the general categories commonly used. Compared to the characterization framework proposed by [11], in this work we focus solely on the implementation phase. This approach allows us to go a step further in the characterization of participation methods by providing an additional

[2]https://ourhealthydata.eu

layer of description, explicitly representing the interactions between actors and technology in the form of a network. In that regard, we present a more functional perspective than other network approaches such [20], as our model is only composed by observable and/or measurable attributes. Thanks to that aspect, this model also fills the purpose and the need of having tools adapted for less experienced and knowledgeable practitioners [9, 8].

Additionally, this model helps to formalize the characterization of each method. This is in line with current works aspiring at a formal definition of all e-participation elements, see [5]. This provides a standard methodology to represent both online and offline methods, allowing a practical evaluation of these different designs and boosting their future combination [1, 2].

6.2. Implications for practitioners

As mentioned, one of the main goals of this model is to become a useful tool for practitioners. The use cases showcased in the previous section help to demonstrate this potential. For instance, the need to define the different elements of the model, which demands an understanding and prior analysis of the implementation setup, can be seen as an interesting asset. This is exemplified in the definition of target audience nodes, which is clearly useful to identify which are the people to be involved in the participation process.

Another important aspect concerns the differentiation between communication and action edges. In these cases, the difference between participants only communicating or taking active actions might help to assess the level of participation achieved by the participation method [31].

6.3. Limitations and future works

This work is nonetheless an ongoing research subject to limitations. The model has been applied to several examples found in the literature to test its reliability at a macroscopic level. However, there is still need to further evaluate the additional utility of the model and to properly define some of its elements. The latter issue refers to the fact that the current model still lacks precise indicators concerning the edges and their weights associated.

The evaluation of these aspects will be carried out in future works based on direct feedback obtained from practitioners. In-depth interviews with practitioners will help to specifically identify which are the main factors that should define the weights of the edges; e.g. communication or representation. Then, practitioners will be asked to evaluate the model in terms of additional utility, and to validate and rank the importance of the different elements depicted by the network representation.

7. Conclusions

In this paper we introduced a network-based model to describe online and offline participation methods. The goal was to facilitate the combination of different tools and methods by providing a more detailed representation of all the elements involved in the implementation phase. This model was built by using SNA theory so to represent the social interactions between actors, and it was applied to several use cases to show its reliability and potential application. This paper

represents a first step in the development of a network-based model and, as such, it focused on the definition and introduction of the main concepts.

The main contributions of the presented model are manifold: i) it focuses on a single phase of the e-participation process allowing more granularity in its description, ii) it allows the study of the complementary between between online and offline methods, and the comparison between applications, iii) it can be used during the planning phase once the policy and target audience are defined or during the evaluation process, and iv) it can be easily implemented based on retrievable information.

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